Detailed Response of Objections to Claims raised by Examiner

Response to each of the points 6 to 15 raised by Patent Examiner are noted following the Statement of Facts that highlight the overall difference in scope and approach claimed in the Patent Application "Systems and Method for Data Encryption and Compression (EnCompression)" application number 10/749,024 compared to that of US patents 6,456,744 and US 6,567,781.

In this response the patent application number 10/749,024 is referred to as PCPA (Pal Chaudhuri Patent Application) while US patents 6,456,744 and 6,567,781 are referred to as LP (Lafe Patent).

I Statement of Facts

A few facts in respect of the difference between scope and approach of PCPA and LP are clearly stated in this section. The only common feature in both PCPA and LP is the use of the computing model referred to as Cellular Automata (CA) that has evolved since 1950's through the works of John v Neumann and a large number of other researchers.

(1) Cellular Automata (CA) is a dynamical system that evolves in discrete space and time. During any such evolution the current state of a CA gets transformed to another state. Depending on the rules used for CA cells, the CA transforms will vary. There are hundreds of millions of such CA transforms possible. For example, for an n cell three neighborhood CA there are $\mathbf{256^N}$ number of transforms. The CA research community do analyze and study different transforms for specific applications. So the term CA Transform is the most generic term and **can not be claimed as a proprietary** by any author. A large number of books and publications deal with various aspects of CA transforms and their applications. Two reference book are enlisted below.

Reference 1: Additive Cellular Automata: Theory and Applications, Volume 1
Authors: Parimal Pal Chaudhuri, Dipanwita Roy Chowdhury, Sukumar Nandi, Santanu Chattopadhyay
ISBN: 978-0-8186-7717-5 July 1997, Wiley-IEEE Computer Society Press

Reference 2: A New Kind of Science
Author: Stephen Wolfram
ISBN 1-57955-008-8 Published by Wolfram Media (2002)

(2) **The term ENCOMPRESSION (as used in PCPA) does not refer to the process of Compression.** This term is used in the PCPA as an acronym for the INTEGRATED process of ENcryption and COMPRESSION = ENCOMPRESSION. Over the last few decades the art of Compression and Encryption have evolved as two different research sub-disciplines with totally opposite objectives. The PCPA claims ENCOMPRESSION (integrated compression and encryption) of data as the innovation and never patented before. LP is restricted to Video/Audio Compression with no reference to encryption in the claims.

(3) Two distinct approaches for compression have evolved over the last few decades - Transform based Compression, and Vector Quantization scheme. While LP employs transform based compression scheme, the PCPA employs Vector Quantization based Compression.

(4) PCPA claims the use of CA technology for integrated ENCOMPRESSION (Encryption and COMPRESSION)operation on **any data type** and is not restricted solely to COMPRESSION of video/audio data as claimed in LP.

II Responses to each point noted in the Rejection of the Claims by the Patent Examiner

(1) Examiner's Point # 6 in rejection of claims 1, 11, 21:

" --- Lafe discloses a method/system/logic encoded in media of encompressing a data stream ----- ----- using one or more Multiple Attractor Cellular Automata (MACA (see col 2 lines 30-38, col 15 lines 49-51); and encrypting the compressed vectors using multiple Cellular Automata (CA) transforms (See col 9 lines 13-53, col 11 lines 38-46).

Lafe's patent US 6,456,744 Col 2 lines 30-38 claims:
"According to another aspect of the present invention, there is provided an apparatus for compressing video data comprising: means for determining a multi-state dynamical rule set and an associated transform basis function; means for receiving M frames of input video data; means for performing a forward transform using the transform basis function to obtain transform coefficients suitable for reconstructing the M frames of input video data; and means for encoded the transform coefficients."

Lafe's patent US 6,456,744 Col 15 lines 49-51 claims:
"In using Cellular Automata Transforms to compress data, the redundancy is identified by transforming the data into the CA space. The principal strength of CAT-based compression is the.."

Lafe's patent US 6,456,744 Col 9 lines 13-53 claims:
"...transform coefficients (and/or to scale transform coefficients), and the quantized transform coefficients are stored. Then, an inverse transform is performed to reconstruct the original test data (using the transform bases and transform coefficients) in a decoding process (step 512- - - - - - If the resulting error size and file size are closer to the selected objective function than any previously obtained results, then store the coefficient set W as - - - - - - - - Thereafter, store and/or transmit N, m, K, T, BC and BestW, and Best Building Blocks (step 520). One or more of these values will then be used to compress/decompress actual video data, as will be described in detail below.
It should be appreciated - - - - - - - - - -In this case, further processing will be necessary in the encoding process to derive the building blocks (i.e., transform bases).
It should be appreciated- - - - - - - - -filter A of size N.times.N is applied in the form: "

Lafe's patent US 6,456,744 col 11 lines 38-46 claims:
"Continuing to step 610, the quantized transform coefficients are stored and/or transmitted. During storage/transmission, the quantized transform coefficients are preferably coded (step 612). In this regard, a coding scheme, such as embedded band-based threshold coding, bit packing, - - - - - - - -Embedded band-based coding will be described in further detail below. The quantized transform coefficients form the compressed image data that is transmitted/stored."

Response from Applicant:

Nowhere in LP does it claim Encryption or integrated Encryption and Compression (ENCOMPRESSION) as claimed in PCPA. The term ENCOMPRESSION used in PCPA refers to an integrated process of Encryption and Compression. Lafe's patent highlights only Compression and that too for only Video/audio data.

Further, as noted in Section I (of this response), CA Transform is a generic term used over several decades. No author can claim it as an invention or infringement of intellectual property simply stating "CA transforms for Video Compression" unless one uses the exact same CA rules for transform based compression.

The term Multiple Attractor Cellular Automata (MACA) was first coined by the author of the PCPA in page 69 Section 4.3 Chapter 4 of Reference 1 (Section I of this response). No previous reference to MACA can be found in literature and patent review prior to this publication. The objection of the examiner on Claims 1, 11, 21 on grounds that Lafe's patent uses one or more MACA is incorrect and strongly objected.

(2) Examiner's Point # 7 in rejection of claims 2, 12, 22:

"--- Lafe discloses the method/system/logic encoded in media wherein compressing the vectors and encrypting the compressed vectors is a single integrated process implemented with a program executed on a Programmable CA (PCA) (See col 5 lines 30-35, col 8 lines 29-48)

Lafe's patent US 6,456,744 col 5 lines 30-35 claims:
"In general, the rule governing the evolution of the cellular automaton will encompass m sites up to a finite distance r away. Thus, the cellular automaton is referred to as a K-state, m-site neighborhood CA. FIG. 1 illustrates a multi-state one-dimensional cellular automaton."

Lafe's patent US 6,456,744 col 8 lines 29-48 claims:
Referring now to FIG. 5, there is shown a flow chart illustrating the steps involved in generating an efficient transform basis function (comprised of "building blocks"), according to a preferred embodiment of the present invention. - - - - Typical rule set parameters include CA rule of interaction, maximum number of states per cell, number of cells per neighborhood, number of cells in the lattice, initial configuration of the cells, boundary configuration, geometric structure of the CA space (e.g., one-dimensional, square and hexagonal), dimensionality of the CA space, type of the CA transform (e.g., standard orthogonal, progressive orthogonal, non-orthogonal and self-generating), and type of the CA transform basis functions. For purposes of illustrating a preferred embodiment of the present invention, the rule set includes:

Response from Applicant:

The term Programmable CA (PCA) was coined by the author of PCPA in page 52 section 3.8 in Chapter 3 of Reference 1 (Section I of this response). The LP entitled "Method and Apparatus for Video compression using sequential frame cellular automata transform" is dedicated for Video Compression only and never claims that it employs encryption along with compression as an integrated process. Neither does it claim that it employs PCA as a building block for compression.

In view of the point # 2 noted under Section I (of this response), examiner's statement that " Lafe ------compressed vectors and encrypting the compressed vectors is a single integrated process" is not valid. LP employs CA transform for compression for video/audio data only. Rejection of PCPA claiming that Lafe's patent does an integrated process of compression and encryption for any data type is not valid. Nowhere in the entire Lafe's application does it claim integrated compression and encryption or any form of encryption.

(3) Examiner's Point # 8, 9 and 10 in rejection of claims 3, 13, 23, 4, 14, 24, 5, 15 and 25:

Point# 8: "--- Lafe discloses the method/system/logic encoded in media further comprising generating a code-book, the one or more MACAs operable to perform binary searches in the code-book, to compress the vectors from the data stream (col 5 lines 20-63 and col 6 lines 40-60)

Point# 9: "---Lafe discloses the method/system/logic encoded in media further comprising storing the code-book using one or more multi-stage MACA-based two class classifiers which act as implicit memory to store the code-book (See col 11 lines 38-57)

Point# 10: "---Lafe discloses the method/system/logic encoded in media wherein compressing the vectors from the data stream using one or more MACAs comprises deriving code-book indices for the vectors (See col 5 lines 30-35, col 8 lines 29-48)

Lafe's patent US 6,456,744 col 5 lines 20-63 claims:
"Cellular Automata (CA) are dynamical systems in which space and time are discrete. The cells are arranged in the form of a regular lattice structure and must each have a finite number of states. - - - -In general, the rule governing the evolution of the cellular automaton will encompass m sites up to a finite distance r away. Thus, the cellular automaton is referred to as a K-state, m-site neighborhood CA. FIG. 1 illustrates a multi-state one-dimensional cellular automaton.
...
...
Hence, each set of W.sub.j results in a given rule of evolution. The chief advantage of the above rule-numbering scheme is that the number of integers is a function of the neighborhood size; it is independent of

the maximum state, K, and the shape/size of the lattice."

Lafe's patent US 6,456,744 col 6 lines 46-60 claims:
The simplest transform basis functions are those with transform coefficients (1,-1) and are usually derived from dual-state cellular automata. Some transform basis functions are generated from the instantaneous point density of the evolving field of the cellular automata. Other transform basis functions are generated from a multiple-cell-averaged density of the evolving automata.
...
(a) Manageable alphabet base for small neighborhood size, m, and maximum state K. This is a strong advantage in data compression applications. (b) The possibility of generating higher-dimensional bases from combinations of the one-dimensional. (c) The excellent knowledge base of one-dimensional cellular automata.

Lafe's patent US 6,456,744 col 11 lines 28-57 claims:
"Continuing to step 610, the quantized transform coefficients are stored and/or transmitted. During storage/transmission, the quantized transform coefficients are preferably coded (step 612). In this regard, a coding scheme, such as embedded band-based threshold coding, bit packing, run length coding and/or special dual-coefficient Huffman coding is employed....
...
there is shown a summary of the process for decoding the compressed video data. First, coded transform coefficients are decoded (step 702), e.g., in accordance with an embedded decoding process (step 702)"

Lafe's patent US 6,456,744 col 5 lines 30-35 claims:
"In general, the rule governing the evolution of the cellular automaton will encompass m sites up to a finite distance r away. Thus, the cellular automaton is referred to as a K-state, m-site neighborhood CA. FIG. 1 illustrates a multi-state one-dimensional cellular automaton."

Lafe's patent US 6,456,744 col 8 lines 29-48 claims:
"Referring now to FIG. 5, there is shown a flow chart illustrating the steps involved in generating an efficient transform basis function (comprised of "building blocks"), according to a preferred embodiment of the present invention. At step 502, TestVideo data is input into a dynamical system as the initial configuration of the automaton, and a maximum iteration is selected. Next, an objective function is determined, namely fixed file size/minimize error or fixed error/minimize file size (step 504). At steps 506 and 508, parameters of a dynamical system rule set (also referred to herein as "gateway keys") are selected. Typical rule set parameters include CA rule of interaction, maximum number of states per cell, number of cells per neighborhood, number of cells in the lattice, initial configuration of the cells, boundary configuration, geometric structure of the CA space (e.g., one-dimensional, square and hexagonal), dimensionality of the CA space, type of the CA transform (e.g., standard orthogonal, progressive orthogonal, non-orthogonal and self-generating), and type of the CA transform basis functions."

Response from Applicant:

Similar to any other transform based data compression, LP employs certain CA transforms, identifies transform coefficients, quantize and encode the coefficients for transmission to the destination. The receiving device uses the transfer function and received quantized transform coefficients to recreate the original video/audio sets.

PCPA takes a completely different approach in Compression and Encryption. Unlike transform based data compression, PCPA employs Vector Quantization method of data compression and encryption. It utilizes code-book for storing code vectors and efficient search of codebook with MACA. Nowhere in the LP, claims have been made in respect of use of code book to store the data elements and search of the code book using one or more MACAs.

Hence the objections raised by the examiner on Points# 8,9,10 are not valid.

(4) Examiner's Point # 11, 12 and 13 in rejection of claims 6, 16, 26, 7, 17, 27, 8, 18 and 28:

Point# 11: "--- Lafe discloses the method/system/logic encoded in media wherein encrypting the compressed vectors using multiple CA transforms comprises using a series of reversible transforms that use one or more of linear CA, additive CA, and non-linear CA configured in a PCA at one or more different time steps (See col 6 lines 32 through col 7 lines 65).

Point# 12: "--- Lafe discloses the method/system/logic encoded in media comprising encrypting the compressed venctors using four levels of CA transforms (See col 6 lines 32 through col 7 lines 65)

Point # 13: Lafe discloses the method/system/logic encoded in media wherein encrypting the compressed vectors using multiple CA transforms comprises using one or more linear transformations, affine transformations and non-affine transformations (See col 6 lines 32 through col 7 lines 65).

Lafe's patent US 6,456,744 col 6 lines 32 through col7 lines 65 claims:
"A given CA transform basis function is characterized or classified by one (or a combination) of the following features: (a) The method used in calculating the bases from the evolving states of cellular automata. (b) The orthogonality or non-orthogonality of the transform basis functions. (c) The method used in calculating the transform coefficients (orthogonal transformtation is generally the easiest).

The simplest transform basis functions are those with transform coefficients (1,-1) and are usually derived from dual-state cellular automata. Some transform basis functions are generated from the instantaneous point density of the evolving field of the cellular automata. Other transform basis functions are generated from a multiple-cell-averaged density of the evolving automata.

One-dimensional (D.ident.1) cellular spaces offer the simplest environment for generating CA transform bases. They offer several advantages, including: (a) Manageable alphabet base for small neighborhood size, m, and maximum state K. This is a strong advantage in data compression applications. (b) The possibility of generating higher-dimensional bases from combinations of the one-dimensional. (c) The excellent knowledge base of one-dimensional cellular automata.
.....
In most applications it is desirable to have transform basis functions that are orthogonal. Accordingly, the transform bases A.sub.ik should satisfy.."

Response from Applicant:

The claim that LP does encryption along with compression is not valid. Nowhere in LP has it claimed that it employs the encryption process. The LP elaborates the use and search of appropriate CA transforms for efficient compression of video/audio data files only. An integrated operation of Encryption and COMPRESSION (ENCOMPRESSION) has never been claimed in Lafe's patents.

Consequently, the Points # 11, 12 and 13 of patent examiner are not valid as per literature review.

Encoding the quantized transform coefficients (as done in LP for compression of video/audio files) and the process of Encryption are totally different with two different objectives. While the sole objective of encoding of quantized transform coefficients as used in LP is to use minimum number of bits per symbol transmitted for most efficient compression, the process of encryption incorporates dispersion of data elements in order to avoid any form of consistency of encrypted data so as to eliminate any easy decryption of data by hackers. Hence the objectives of compression as used in LP could never equate to encryption because the approach taken by LP is solely encoding the video/audio data as best as possible for compression with no claims in LP for encryption.

The PCPA takes a different approach of integrating the Compression and Encryption by a Vector Quantization process with the use of Code-Book which results in a far more advanced form of encrypting and compressing of any data type in a single integrated process.

(5) Examiner's Point # 14 and 15 in rejection of claims 9, 19, 29, 10, 20, 30:

Point# 14: "--- Lafe discloses the method/system/logic encoded in media wfurther comprising transmitting the encompressed data across a communications link (col 3 lines 47-50 and col 4 lines 29-53)

Point# 15: "--- Lafe discloses the method/system/logic encoded in media further comprising decrypting the transmitted encompressed data using multiple CA transforms (See col 9 lines 14-35 and col 11 lines 50-67)

Lafe's patent US 6,456,744 col 3 lines 47-50 claims:
"Another advantage of the present invention is the provision of a method and apparatus for digital video compression which provides faster data transmission through communication channels."

Lafe's patent US 6,456,744 col 4 lines 29-53 claims:
"*It should be appreciated that while a preferred embodiment of the present invention will be described with reference to cellular automata as the dynamical system, other dynamical systems are also suitable for use in connection with the present invention, such as neural networks and systolic arrays.*

In summary, the present invention teaches the use of transform basis functions (also referred to herein as "filters") to transform video data for the purpose of more efficient storage on digital media or faster transmission through communications channels. A transform basis function is comprised of a plurality of "building blocks," also referred to herein as "elements" or "transform bases." According to a preferred embodiment of the present invention, the elements of the transform basis function are obtained from the evolving field of cellular automata. The rules of evolution are selected to favor those that result in orthogonal transform basis functions. A special psycho-visual model is utilized to quantize the ensuing transform coefficients. The quantize transform coefficients are preferably stored/transmitted using a hybrid run-length-based/Huffman/embedded stream coder. The encoding technique of the present invention allows video data to be streamed continuously across communications networks."

Lafe's patent US 6,456,744 col 9 lines 14-35 claims:
Then, an inverse transform is performed to reconstruct the original test data (using the transform bases and transform coefficients) in a decoding process (step 512). The error size and file size are calculated to determine whether the resulting error size and file size are closer to the selected objective function than any previously obtained results (step 514). If not, then new W-set coefficients are selected. Alternatively, one or more of the other dynamical system parameters may be modified in addition to, or instead of, the W-set coefficients (return to step 508). If the resulting error size and file size are closer to the selected objective function than any previously obtained results, then store the coefficient set W as BestW and store the transform bases as Best Building Blocks (step 516). Continue with steps 508-518 until the number of iterations exceeds the selected maximum iteration (step 518). Thereafter, store and/or transmit N, m, K, T, BC and BestW, and Best Building Blocks (step 520). One or more of these values will then be used to compress/decompress actual video data, as will be described in detail below.

Lafe's patent US 6,456,744 col 11 lines 50-67 claims:
The quantized transform coefficients are transmitted to a receiving system which has the appropriate building blocks, or has the appropriate information to derive the to building blocks. Accordingly, the receiving device uses the transfer function and received quantized transform coefficients to recreate the original video data. Referring now to FIG. 7, there is shown a summary of the process for decoding the compressed video data. First, coded transform coefficients are decoded (step 702), e.g., in accordance with an embedded decoding process (step 702) to recover the original quantized transform coefficients (step 704). An inverse transform (equation 3) is performed using the appropriate transform function basis and the quantized transform coefficients (step 706). Accordingly, the image data is recovered and stored and/or transmitted (step 708). It should be appreciated that a "sub-band" inverse transform may be optionally performed at step 706, if a "sub-band" transform was performed during the encoding process described above.

Response from Applicant:

Similar to any transform based compression (employed in last few decades), LP employs compression of video/audio stream with reversible CA transforms, transmission of the compressed stream (in terms of encoded transform coefficients), receiving the stream at the destination and restoring back the original data. The innovativeness of any claim is how this process is implemented and how effective the compression is in respect of compression ratio. The essence of compressing data is for faster transmission via any communication channel which is a known fact for centuries.

LP does compression only for video/audio data with a focus to identify desired CA for efficient compression and transmission of compressed data to destination. The focus of LP is to identify CA transforms for efficient compression and the question of encryption does not arise because Encoding of transform coefficients and the process of Encryption, as explained earlier, are totally different.

Hence, the points # 14 and # 15 of patent examiner - "Transmitting of ENCOMPRESSED data" and "Decrypting of ENCOMPRESSED data" in LP is not valid.

The PCPA employs the traditional method of Vector Quantization scheme of data compression and encryption. The focus for PCPA is – (a) to employ efficient search of codebook with multiple MACA to identify the index of codebook that closely matches with an input data block (to be compressed), (b) Encrypting the codebook index with appropriate CA to disperse the set of codebook indices, and (c) Efficient transmit and receipt of this ENCOMPRESSED (Encrypted and COMPRESSED data.

Hence the claim of PCPA is - ENCOMPRESS (Encrypt and COMPRESS) of input data employing CA, transmitting ENCOMPRESSED data, and finally de-ENCOMPRESS (decrypt and decompress) the received data to get back the original data

Conclusion

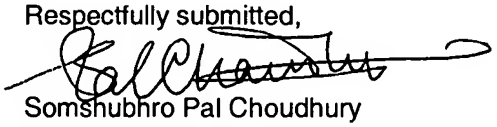
Applicant clearly points out the difference in scope and approach between the applicant's patent application 10/749,024 (Referred to as PCPA) and the Patent US 6,456,744 (Referred to as LP). Based on the analysis of LP, the examiner refuted the claims of PCPA. The applicant strongly refutes the objections raised by the examiner and requests for an in-depth analysis and review of both LP and PCPA. Specific attention is requested to the point number # 2 in Section I (Statement of Facts) that clarifies the fact that the new process of ENCOMPRESSION claimed in the PCPA does not refer to the process of COMPRESSION only but refers to the integrated process of Encryption and COMPRESSION.

The Applicant respectfully request early and favorable action in his case.

If the Examiner believes a telephone conference would clarify details to accelerate action on this case in any way, the Examiner is invited to contact Mr. Somshubhro Pal Choudhury, the Agent for the applicant, Prof Parimal Pal Chaudhuri at 408-910-2936.

Applicant also respectfully requests any clarification of Figures 5-7 (attached) on which part is not clearly seen in the figures.

Respectfully submitted,



Somshubhro Pal Choudhury
Agent for Applicant

Date
Correspondence Address
Office:
NETGEAR Inc.
4500 Great America Parkway
Santa Clara CA – 95054
Email: som.choudhury@netgear.com
Phone: 408-910-2936

Home Address:
1909 Beaufort Terrace
San Jose CA – 95131
Email: somshubhro@gmail.com
Phone: 408-910-2936